

PCT / G B 00 / 03 174



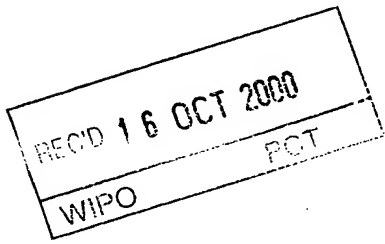
6200/3799  
4



10/089873



INVESTOR IN PEOPLE



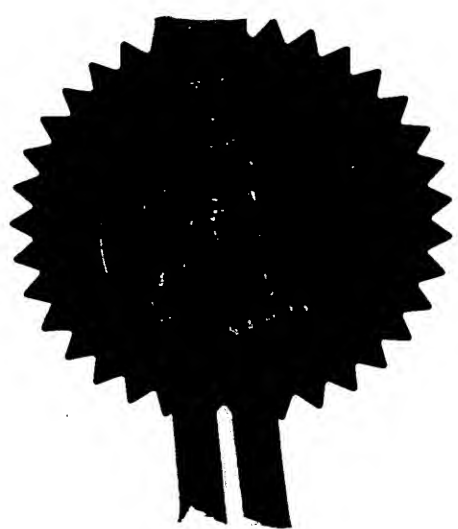
The Patent Office  
Concept House  
Cardiff Road  
Newport  
South Wales  
NP10 8QQ

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.



Signed *Andrew Gorse*  
Dated - 9 OCT 2000

**PRIORITY  
DOCUMENT**  
SUBMITTED OR TRANSMITTED IN  
COMPLIANCE WITH RULE 17.1(a) OR (b)



BEST AVAILABLE COPY

**Request for grant of a patent**

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

06 MAR 2000



The Patent Office

Cardiff Road  
Newport  
South Wales  
NP9 1RH

1. Your reference	REP06376GB		
2. Patent application number (The Patent Office will fill in this part)	0005355.3		
3. Full name, address and postcode of the or of each applicant (underline all surnames)	Freudenberg Ltd. P.O. Box 3 Ellistones Lane Greetland Halifax West Yorkshire HX4 8NJ		
Patents ADP number (If you know it)	77542 3700		
If the applicant is a corporate body, give the country/state of its incorporation	United Kingdom		
4. Title of the invention	NON-WOVEN ABRASIVE MATERIAL		
5. Name of your agent (if you have one)	Gill Jennings & Every		
"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)	Broadgate House 7 Eldon Street London EC2M 7LH		
Patents ADP number (if you know it)	745002 ✓		
6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number	Country	Priority application number (if you know it)	Date of filing (day / month / year)
	GB	9923424.7	04.10.99
7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application	Number of earlier application	Date of filing (day / month / year)	
8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if: a) any applicant named in part 3 is not an inventor, or b) there is an inventor who is not named as an applicant, or c) any named applicant is a corporate body. See note (d))	YES		

## Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form

Description 5

Claim(s) 1

Abstract

Drawing(s)

10. If you are also filing any of the following, state how many against each item.

Priority documents

Transitions of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination (Patents Form 10/77)

Any other documents (please specify)

NO

11. For the applicant  
Gill Jennings & Every

I/We request the grant of a patent on the basis of this application.

Signature

Date

Gill Jennings & Every

6 March 2000

12. Name and daytime telephone number of person to contact in the United Kingdom

PERRY, Robert Edward

020 7377 1377

### Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

### Notes

- If you need help to fill in this form or you have any questions, please contact the Patent Office on 0645 500505.
- Write your answers in capital letters using black ink or you may type them.
- If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.
- If you have answered 'Yes' Patents Form 7/77 will need to be filed.
- Once you have filled in the form you must remember to sign and date it.
- For details of the fee and ways to pay please contact the Patent Office.

**BEST AVAILABLE COPY****NON-WOVEN ABRASIVE MATERIAL**Field of the Invention

This invention relates to non-woven abrasive materials.

Background to the Invention

5 Non-woven abrasive materials are well known in the art. Many of these articles are manufactured from polyamide fibres (such as Nylon 6 or Nylon 66), and include a binder such as phenol-formaldehyde (PF) resin.

Most known non-woven abrasive products can be reshaped, in use, by a user, but are unable to maintain that shape. Non-woven abrasive products have been developed that may partially retain a user-defined shape. Other products tend to be too coarse (e.g. wire wool) or too soft (such as cotton wool).

US-A-4,355,067 discloses a fibrous scouring material. US-A-5,712,210 discloses a non-woven abrasive material roll.

Summary of the Invention

15 According to the present invention, an abrasive material comprises non-woven, synthetic fibres, and is deformable, and is able to maintain the deformed shape.

Materials of the present invention are useful in a number of applications, for example, where a deformable abrasive material is required. They also allow for alternative methods of delivery to a user, such as pinch extraction from a box or sleeve. In this way, the user may control the quantity of material dispensed for each application. In particular, the abrasive material can be separated into user-defined quantities.

Advantageously, the abrasive material has a low enough tear strength to allow it to be separated into the desired quantity, and a high enough tear strength to maintain a sheet or deformed sheet, when in use.

25 The novel material typically has a lighter and thinner structure than conventional non-woven abrasive materials. The material can be shaped, or "crumpled" into a desired form and has the ability to maintain the crumpled form. This feature arises from a lower degree of rigidity of the material, as compared with

conventional non-woven abrasive materials, together with a tendency of non-woven abrasive materials to engage with one another.

#### Description of the Invention

5 The novel non-woven abrasive material of the present invention may be manufactured from components typically found in conventional non-woven materials, and by processes similar to those used to manufacture conventional non-woven materials. For example, a method of manufacturing the novel non-woven abrasive material of the present invention may comprise the steps of:

- (i) carding staple fibres;
- 10 (ii) cross-lapping to form a fleece;
- (iii) passing the fleece through a calendar roll;
- (iv) spraying the fleece with resin and a filler binder;
- (v) powder-spreading the fleece with abrasive grain; and
- (vi) heating in a forced air oven to dry and cure the resin.

15 It will be obvious to one skilled in the art that alternative methods of preparing non-woven abrasive materials are known. For example, air-laying may be used, instead of carding.

Non-woven abrasive materials of the present invention may be manufactured from three basic elements. In particular, fibres may be used having a fibre weight of  
20 between 20 and 70 g/m<sup>2</sup>. Binders may be used with a binder weight of between 20 and 40 g/m<sup>2</sup>. Abrasive grains may be used having a weight of between 15 and 60 g/m<sup>2</sup>.

More particularly, the fibre may be 100% 17 dtex Polyamide 66. A resin and filler binder may comprise 25% phenol formaldehyde resin and 75% fused alumina  
25 silicate. The abrasive grain may be 100% aluminium oxide 180 grit.

It is understood that any synthetic staple fibre may be used, dependent on the desired use of the product and the binder system employed. Fibre deniers of between 5 and 200, or combinations thereof, may be used, dependent upon the process and also product performance requirements. The fibres used have staple lengths of about  
30 60 mm. This may vary, dependent on product performance and process requirements.

Other abrasives, such as silicon carbide, may be used dependent upon the desired product performance characteristics of the product. It is understood that any

size, or combination thereof, of abrasive grains may be used, for example, between 36 and 1800 grit.

The following Example illustrates the invention.

5 Crimped staple fibres of Nylon 66 with a linear density of 17 decitex and a length of 60 mm are provided in heavily compacted bales. The fibres are opened using a wilying machine and two disc openers, and air-transported to a card. This process has the effect of breaking down the larger clumps of fibre into smaller clusters.

10 The fibres are then processed through the card. This produces a uni-directional fleece of a light weight. This fleece is then passed into a cross-lapper, running at 90° to the direction of the card. A number of layers of fleece are built up from one another to produce a batt of 30 g/m<sup>2</sup>. The batt is then compressed in a pair of calendar rolls.

15 The fibrous batt is then sprayed with an aqueous phenol formaldehyde (PF) resin and mineral filler slurry. The slurry includes a small percentage (<1% wt.) of pigment. Water is also added to the slurry to reduce its solids content and viscosity, thus allowing it to be sprayed. At the time of spraying, the slurry is about 70% solids.

20 The components making up the slurry are added together to give a total mix weight of about 800 kg. This mix is continually agitated to prevent the solid particles of filler from settling out of suspension.

The proportion of dried PF resin to filler is 1:3 and the dried weight is 50 g/m<sup>2</sup>.

The wet and uncured fibre batt is passed under a powder spreader, which applies abrasive grain. The abrasive grain will adhere to the PF resin, when cured.

The abrasive grain used is 50 g/m<sup>2</sup> of aluminium oxide 180 grit.

25 The fibre batt, coated with abrasive grain, is passed through a forced air dryer to dry and cure the PF resin. The finished product is enroled or cut into the desired form.

30 The following tests have been carried to quantify the superior "crumpling" properties of the product of this Example, identified below as TF4973. 3M 7447, 3M 7448, and Freudenberg 3635, are commercially available non-woven abrasive products.

# BEST AVAILABLE<sup>4</sup> COPY

## Test 1

A sample of size 204mm x 100mm was "crumpled" by hand. It was then released and left for 15 seconds to recover any of its original shape. The maximum and minimum axes were then measured and the retained form noted.

5

Table 1

	Minimum and Maximum Axes (mm)	Observed Form
3M 7447	80 x 60	Partially opens up and retains an
3M 7448	80 x 80	"open" scrunched form.
Freudenberg 4635	200 x 100	Recovers its original flat, sheet form.
TF4973	40 x 40	Opens very little and retains a tight ball like structure

10

## Test 2

15

Samples of 30 mm width and different lengths were folded in half across the shorter dimension. A 9 g weight, surface area 380mm<sup>2</sup>, diameter 22mm, was placed on the non-folded end. The weight was then removed and it was recorded whether or not the sample unfolded itself to lie flat again, or remained folded. The fold was not creased in any way. The greater the engagement force and the lower the rigidity, the greater the likelihood that the sample will remain folded after removal of the weight. The smaller the sample, the less likely the sample will remain closed.

20

Table 2 Fraction of Samples Remaining Closed

	Sample Length		
	20 cm	10 cm	5 cm
3M 7447	4/10	0/10	0/10
3M 7448	2/10	1/10	0/10
Freudenberg 4635	0/10	0/10	0/10
TF4973	10/10	10/10	9/10

25

30



TF 4973 was compared with Freudenberg 4639, another commercially available non-woven abrasive material, in order to demonstrate its lower tear strength. The results are shown in Table 3.

5 Table 3

	Tensile strength (length) (N/50 mm)	Tensile strength (width) (N/50 mm)	Tear strength (N)	Fleece weight (g.m <sup>-2</sup> )	Finished weight (g.m <sup>-2</sup> )
TF4973	19	30	6	30	130
Freudenberg 4639	30	60	12	70	330

10

CLAIMS

1. An abrasive material comprising non-woven, synthetic fibres, which is deformable, and which is able to maintain the deformed shape.
- 5 2. An abrasive material according to claim 1, which can be separated in user-defined quantities.
3. An abrasive material according to either preceding claim, wherein the abrasive is in the form of grains which are held in the material by a resin or other binder.
4. An abrasive material according to any preceding claim, wherein the grains are grains of aluminium oxide.
5. An abrasive material according to any preceding claim, having a tear strength of less than 12 N.
6. A sheet of an abrasive material according to any preceding claim.
7. A method of abrading a surface, which comprises contacting the surface with  
15 a sheet according to claim 6.
8. A method of abrading a surface, which comprises contacting the surface with a sheet according to claim 6, wherein the sheet is obtainable from a larger sheet of the material having a sufficiently low strength to allow it to be separated into smaller sheet, of a desired size, and a sufficiently high strength to maintain the sheet of  
20 material when in use.